

How do Hungarian preschoolers interpret number words?

Research question

The talk reports on two experiments in which we investigated children's understanding of number words in Hungarian. It has been claimed that the distinction between numerals' lower-bounded ('at least n ') and upper-bounded ('exactly n ') meaning is grammaticalized in Hungarian, i.e. numerals appearing in the so called 'focus position' obligatorily receive an 'exactly' interpretation, while numerals in other positions are assigned an 'at least' semantics in the unmarked case. In the first experiment we found that irrespective of the information structure of the sentence, Hungarian preschoolers highly prefer the upper-bounded interpretation of numerals. In the second experiment we tested whether the lower-bounded reading can be elicited by providing a context that facilitates the lower-bounded interpretation. The results we obtained suggest that in the case of children the manipulation of the pragmatic environment does not affect the tendency of interpreting the numerals as 'at least n '.

Background

It has been a source of much debate what numerals mean by default. On the standard neo-Gricean view (Horn 1972, Levinson 2000) numerals, just like other scalar terms, have a lower bounded ('at least') semantics and the upper bounded ('exact') meaning is considered to be a scalar implicature that can be derived from Grice's Quantity Maxim. Others have adopted the view that the default meaning of numerals is 'exactly n ' and all the other readings can be derived from it (Geurts 2006, Breheny 2008). One way of settling this debate is to investigate the acquisition path of number words, which is why it has become a recurrent topic in the psycholinguistic literature. Papafragou & Musolino (2003) and Musolino (2004) conducted several experiments with preschoolers and they found that by the age of 5 children can assign numerals the full range of interpretations available in the adult grammar. However, they have difficulty accessing the 'at least' interpretation, which challenges the neo-Gricean view on numerals.

Hungarian facts

Hungarian deserves special attention in this matter because in Hungarian the interpretation of numerals is claimed to be structure dependent (É. Kiss 1998, 2010). Numerals appearing in the focus position (the position immediately preceding the tensed verb) are assigned an 'exact' semantics irrespective of pragmatic factors, which is the outcome of the [+exhaustive/+maximal] feature associated with this preverbal position. Numerals appearing elsewhere in the sentence normally have an 'at least' semantics.

Experiment 1

In the first experiment we investigated whether information structure has any effect on how children interpret number words. Previous research has shown that children are generally not sensitive to the exhaustive feature of Hungarian identificational focus (Lukács–Kas 2013, self reference 2011) which is claimed to be responsible for the upper-bound reading of numerals. Therefore we hypothesized that if the interpretation of numerals is indeed determined by the information structure, then the upper-bound ('exactly') reading would be less accessible to them.

Method

We tested 16 Hungarian speaking children in the experiment (mean age: 6; 5). One of the experimenters told the child short stories about a group of toy bears who had to perform different tasks (e.g. picking raspberries). The bears showed Hedgehog (a puppet acted by the other experimenter) how many raspberries they had picked. Each bear had a card in front of him depicting a set of raspberries ranging from 2 to 6. Hedgehog brought some candies to reward the bears and she told the child which bears could get a candy, i.e. she uttered the test sentence containing a number word. The child had to give a candy to the bears who matched the puppet's description. The numeral appeared either in (1) or out of focus (2) in the test sentences. E.g.:

- (1) Azok a macik kapjanak cukorkát, akik NÉGY MÁLNÁT szedtek.
those the bears get-SUBJ candy-ACC who-PL four raspberry -ACC picked
'Those bears should get a candy who picked/have four raspberries.'

(2) Azok a macik kapjanak cukorkát, akik szedtek négy málnát.
those the bears get-SUBJ candy-ACC who-PL picked four raspberry-ACC
'Those bears should get a candy who picked/have four raspberries.'

If the child gave a candy to the bears who had more than four raspberries, then she interpreted the numeral as 'at least n '.

Results

While in the case of adults the rate of upper-bound interpretations was significantly higher when the numeral appeared in focus position ($\chi^2 = 99.5$, $df = 3$, $p = .0001$), children consistently did not differentiate between the two readings. They always preferred the 'exactly' reading, regardless of the information structure of the sentence.

Experiment 2

The results of Experiment 1 raised the question whether the 'at least' reading is not available at all, or it is, but it needs pragmatic support. To test this latter hypothesis, we carried out a follow-up experiment in which we tried to provide a context that was biased toward the 'at least' interpretation.

Method

We arranged a game that had two participants, the child and Hedgehog (a puppet acted by one of the experimenters). They had a pile of cards in front of them depicting different things (e.g. flowers and butterflies). The task was to sort out the cards that had the same thing on them (i.e. all the cards with flowers or all the cards with butterflies). The number of cards of the two types were carefully arranged in advance, so after finishing sorting out the cards the child ended up having two more cards than the puppet (e.g. child: 6 cards, Hedgehog: 4 cards) Then the experimenter put some balloons on the table and told the terms of taking a balloon:

(3) *Elvehet egy lufit az, akinek van öt kártyája.*
can.take a balloon-ACC (s)he who.DAT has five card.3SG
'If anybody has five cards, he or she can take a balloon.'

Crucially, the numeral in (1) appeared out of focus so it was compatible with the 'at least' and 'exactly' readings alike. The game was repeated several times with different cards and number settings. We recorded how many times the child took a balloon, which indicated that she interpreted the numeral as 'at least n '.

Results

Children performed rather poorly on this task: only 11% of them took a balloon consequently in the critical trials, though it was clear that the purpose of the game was to collect balloons and not to demonstrate how good they were at counting.

Conclusions

The results we obtained in Experiment 1 strongly favour the view that the default meaning of numerals is in fact 'exactly n '. Furthermore, the results of Experiment 2 suggest that the lower-bounded ('at least') reading of numerals is not accessible to children even if the pragmatic context facilitates this interpretation. It is possible that children at this age are unable to decompose a set of entities into smaller subsets, which is a prerequisite of understanding the lower bound meaning of numerals. It means that they treat a set of n items as a single, atomic unit and they do not have access to the individual entities through the set. This is in line with what Pica & Lacomte (2008) assume to be the reason why the Mundurucus have difficulties with numerosities larger than 3.

Selected references: É. Kiss, Katalin (2010) Structural focus and exhaustivity. In Malte Zimmermann and Caroline Féry (eds.), *Information structure: Theoretical, typological and experimental perspectives*. Oxford: Oxford University Press. 64–88. Geurts, Bart (2006) Take 'five'. The meaning and use of a number word. In Liliane Tasmowski and Svetlana Vogeleer (eds.), *Indefiniteness and plurality*. Amsterdam: John Benjamins. 311–329. Levinson, Stephen (2000) *Presumptive meanings: The theory of generalized conversational implicature*. Cambridge, MA: MIT Press. Musolino, Julien (2004) The semantics and acquisition of number words: Integrating linguistic and developmental perspectives. *Cognition* 93: 1–41. Pica, Pierre, Lecomte, Alain (2008) Theoretical implications of the study of numbers and numerals in Mundurucu. *Philosophical Psychology* 21(4): 507–522.